0050470

Meeting Minutes
Interim Status Dangerous Waste Tank Systems
Hanford Federal Facility Agreement and Consent Order
Milestone M-32-00

PROJECT MANAGERS MEETING
March 5, 1997

The undersigned indicate by their signatures that these meeting minutes reflect the actual occurrences of the above dated Project Mangers Meeting (PMM).

Not Present

Date: ______________

W. R. Brown, Representative, Fluor Daniel Hanford, Inc.

Date: 9-29-97

D. E. Jackson, ~~Project Manager,~~ Department of Energy, Richland Operations Office

Date: 9/4/97

J. M. Thurman, Representative, Lockheed Martin Hanford Corporation

Date: ______________

R. W. Wilson, Unit Manager, Washington State Department of Ecology

Purpose: Discuss current Double-Shell Tank Farm issues related to Milestone M-32-00.

Meeting minutes are attached. The minutes are comprised of the following:

- Attachment 1 - Summary of Discussion, Agreements and Actions
- Attachment 2 - Attendance List
- Attachment 3 - "Review of Ultrasonic Inspection Status of Hanford Double-Shell Tanks"

MEMO

Interim Status Dangerous Waste Tank System
Hanford Federal Facility Agreement and Consent Order
Milestone M-32-00 Project Managers Meeting minutes
March 5, 1997

The following Tri-Party Agreement M-32-00 Project Managers Meeting minutes have not been signed by the Washington State Department of Ecology (Ecology). Ecology believes that the minutes (submitted August 29, 1997) are too old to accurately be assessed. Therefore, the minutes are issued without Ecology's signature.

This meeting was held on March 5, 1997 to discuss the proposed Double-Shell Tank interim milestone addition to the major M-32-00 milestone.

Attachment(s): None

MILESTONE M-32-00
PROJECT MANAGERS MEETING
March 5, 1997

Summary of Discussion, Agreements and Actions

This meeting was held to discuss the Sub-Tank Integrity Structural Panel (Sub-TSIP) report, "Review of Ultrasonic Inspection Status of Hanford Double-Shell Tanks," dated February 14, 1997. Mr. Kamal Bandyopadhyay of the Sub-TSIP participated in this meeting by phone.

Before beginning discussions on the above-mentioned ultrasonic (UT) inspection review report, Mr. Dale Jackson, of the U.S. Department of Energy, Richland Operations Office (RL) asked Ms. Laura Cusack, of the Washington State Department of Ecology (Ecology), to provide a letter for the independent, qualified, registered professional engineer (IQRPE) on the Double-Shell Tank (DST) assessment scope (six tanks). Ms. Cusack agreed to provide this letter and will send Mr. Jackson a draft of it as soon as possible.

After a brief review of the report, Ms. Cusack expressed a concern that the 20" vertical strip used during the DST UT inspections did not accommodate the TSIP's original guidelines of inspecting 5% of a tank's surface. She was concerned that various critical areas (liquid/vapor interface, sludge/liquid interface) would not be properly inspected. Mr. Bandyopadhyay stated that the Sub-TSIP had also considered this dilemma and determined that the 20" vertical strip is a reasonable approach to take. As to the specific areas Ms. Cusack mentioned, he said that the liquid/vapor and the sludge/liquid interface levels varied in the Hanford DSTs thereby lowering the residence time of these interface levels at any one location. Therefore, the TSIP's original concerns over the effects of these interface areas, which resulted in the 5% inspection guideline, diminishes.
Mr. Bandyopadhyay offered to provide written justification for the Sub-TSIP's position that the 20" vertical strip is acceptable.

Mr. Bob Wilson (Ecology) asked if the 20" strip would be able to sufficiently cover the required area of a vertical weld. Mr. Keith Scott, of the SGN Eurisys Services Corporation (SESC), responded that it was possible to follow a vertical weld down the tank wall. He pointed out that the tank 30' wall plates were staggered and so were the vertical welds. Mr. Bandyopadhyay said that inspecting one weld should be sufficient to determine if the weld has the potential for cracking. After discussing the merits vs. the lack of value of inspecting a vertical weld, Mr. Bandyopadhyay volunteered to provide Mr. Scott with some literature on the subject.

Next, the affect of scaling on the signal quality was discussed. Mr. Scott mentioned that the UT equipment vendor did not keep the A-scan image information from the AW tank inspection. He said that this type of information would be reviewed as recommended in the report during the next tank inspection.

Mr. Scott asked Mr. Bandyopadhyay to clarify how the Sub-TSIP's suggestion of inspecting a few single-shell tanks (SSTs) affects the DST assessment strategy. As there is no clear understanding as to why some SSTs have leaked, Mr. Bandyopadhyay stated that some inspection of the SSTs could put to rest any potential questions others may have about the DST assessments. He emphasized that lacking these inspections in no way casting any doubt on the DST assessment approach. He suggested that these inspections be performed "somewhere down the road." Mr. Scott acknowledged that while it was not possible for SSTs inspections to be added to the DST assessment activities, inspection of a few SSTs would someday be valuable. At this point in the meeting, Mr. Bandyopadhyay hung up and the discussion went on without him.

Ms. Cusack mentioned that with the different positions taken on certain issues getting an IQRPE on board now could minimize potential public questions on the DST assessment strategy. She acknowledged it would be sufficient if an IQRPE agreed to the DST assessment scope and that Ecology's agreement was not needed.

The topics for discussion during the next PMM, scheduled for March 10, 1997 at 3:00 pm, are the TSIP report (should Ecology need more time for review), the IQRPE's certification statement, who will perform as the IQRPE, and change control form "representative sample" wording.

Attachment 2

MILESTONE M-32-00
PROJECT MANAGERS MEETING
March 5, 1997

Attendees

NAME	ORGANIZATION
Kamal Bandyopadhyay (by phone)	Sub-TSIP
Laura Cusack	Ecology
Dale Jackson	DOE/RL-EAP
Dan Pfluger	Lockheed Martin Hanford Corporation
Mark Ramsay	DOE/RL-WSD
Keith Scott	SGN Eurisys Services Corporation
Ana Sherwood	Rust Federal Services of Hanford Inc.
Jack Thurman	Lockheed Martin Hanford Corporation
Bob Wilson	Ecology

M-32-00 PROJECT MANAGERS MEETING

March 5, 1997

NAME	ORGANIZATION	TELEPHONE	MSIN
[illegible] Sherwood	RUST	376-6391	H6-22
Dave P[illegible]	LMHC	376-4164	R1-56
Mark F [illegible]	RL	376-7924	S7-54
Laura Cusack	Ecology	736-3038	
Bob Wilson	ECOLOGY	736-3031	B5-18
Keith Scott	SESC	376-5445	B4-51
Jack M. [illegible]	LMHC	373-5609	R1-51
DALE JACKSON	DOE-RL/EAP	376-4851	A5-15
Kamal Bandyopadhyay by phone			

Attachment 3

MILESTONE M-32-00
PROJECT MANAGERS MEETING
March 5, 1997

Review of Ultrasonic Inspection Status of Hanford Double-Shell Tanks

BROOKHAVEN NATIONAL LABORATORY
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Department of Advanced Technology

Building 130

February 27, 1997

Mr. Keith V. Scott
SESC, Mail Stop H5-52
Richland, WA 99352

Subject: Review of the Ultrasonic Inspection Status of the Hanford Double-Shell Tanks

Dear Keith:

Enclosed please find a report we prepared based on the review meeting held in Richland on January 23, 1997, regarding the subject UT inspection. In summary, a Subcommittee of the Tank Structural Integrity Panel (Sub-TSIP) who attended the meeting supports the current work and recommend some refinement as further explained in the attachment.

If you have any questions, please do not hesitate to contact us.

Sincerely yours,

Kamal K. Bandyopadhyay
Kamal Bandyopadhyay

/sm

c: R. Hall
S. Bush
B. Thompson
B. Mather
M. Kassir
D. VanRooyen
J. Weeks
P. Shewmon
M. Streicher
J. Treadway

REVIEW OF ULTRASONIC INSPECTION STATUS OF HANFORD DOUBLE-SHELL TANKS

Kamal Bandyopadhyay, Spencer Bush, and Bruce Thompson

February 14, 1997

INTRODUCTION

A meeting was held in Richland, WA, on January 23, 1997, on the Hanford double-shell tank ultrasonic examination status. Keith Scott organized the meeting, and three members of the Tank Structural Integrity Panel (Sub-TSIP: Spencer Bush, Bruce Thompson, and Kamal Bandyopadhyay) attended the meeting (agenda and attendance list attached). This report includes a brief discussion on the inspection status and provides comments and recommendations of the Sub-TSIP.

INSPECTION STATUS

Keith Scott provided an overview of the tank ultrasonic inspection program (viewgraphs attached) and Gerald Posakony discussed the inspection procedures and results. A tank inspection supplier (SAIC) was retained to provide and use an ultrasonic inspection system (equipment, procedures and inspectors) to examine a 20-inch vertical strip of Tank 241-AW-103 primary and secondary tank watts. It was reported that the results of the inspection were that no indications of wall thinning, pits and cracks in excess of the acceptance criteria were detected on either wall. Keith Scott also described the future UT inspection plan (view graphs attached). By using a set of criteria they have selected six tanks as candidates for inspection: AW-103, AN-107, AY-101, AY-102, AZ-101 and SY-101. The inspection of AW-103 did not include the knuckle region nor the bottom. Future inspections are expected to include an examination (up to 12 ft.) of the bottom knuckle. Attempts will also be made to inspect the tank bottom by introducing transducers into the narrow vent ducts as far as practicable.

COMMENTS AND RECOMMENDATIONS

In general, the Sub-TSIP finds the demonstration of the inspection procedures and use of equipment in the examination of two vertical strips of tank AW-103 walls to follow standard acceptable methods. The sub-TSIP has some concerns regarding the conclusions drawn from the data that there was no noticeable degradation of the inspected portion of the tank walls. While this may be true, it is suggested that the data be reanalyzed in the manner discussed below in PERFORMANCE DEMONSTRATION TESTS under "Effect of Coupling Variations." This should resolve the issue of what, if any, effect the scale on the tank has on the UT data. The sub-TSIP supports the future plan to inspect the bottom knuckle region and the bottom plate as wide as possible. It recommends that the examination bracket at least one vertical weld. The Sub-TSIP also recommends that the failure mechanisms of single-shell tanks that have leaked large volumes of waste should be explored by examining a few of them. These general observations and recommendations are further described and clarified as follows:

1. <u>Performance Demonstration Tests</u>

The performance demonstration tests (PDTs) were quite professionally done. Particularly noteworthy was the fact that they were performed in accordance with well defined ASME procedures, which have benefited from many years of refinement and should bear considerable weight with both the public and the regulatory community. Given that this provides a very strong foundation, there are two areas which could be strengthened by further modest effort.

Effect of Coupling Variations -- The PDTs were performed on a laboratory mock-up having a very good surface finish. When this system is applied in the field, the presence of scale and/or surface roughness may cause a degradation in signal quality. The obvious question is, "How much does this degrade the probability of detection (POD)?" Without some methodology to take this into account, the applicability of the PDT to the field tests could be questioned. Several approaches to addressing this question present themselves. One that could be applied immediately would be to utilize information in the amplitude of the back-surface signal. If the back-surface signals in field tests are lower than those in the PDT, this would imply similar changes in signals from pits and stress-corrosion cracks (SCCs). A simple way to take this into account without performing new experiments would be to perform the POD analysis again with the signals from the pits and SCCs in the laboratory plates reduced by an amount equal to the effect of the field tank surface on the back-surface signal. One could also imagine re-analyzing the field data with the threshold lowered to take into account any reduced coupling as indicated by drops in the back-surface signal. Such an approach would make the POD results of the PDT relevant. However, it might lead to an increase in false calls (FCP) above that observed in the PDT since the threshold would now be closer to the noise. A third, more expensive but stronger approach, would be to repeat PDT on samples with degraded surfaces.

Inspection of Welds -- Further attention should be given to issues associated with the detection of SCCs near welds. This should include an analysis of the SCCs observed at Savannah River, and possibly other places, with particular attention to their location (HAZ or weld material) and orientation (parallel or perpendicular to weld). For SCCs in the HAZ, it is probably the case that the current PDT is adequate. However, if one needs to examine the SCC through weld material, the effect of that material on the signal should be taken into account. A strong technical case needs to be made if weld materials are not included.

2. Extent of Examination

In general, the proposed extent of the examination is reasonable. At this point, there are several possible degradation mechanisms that have been identified. Since there is considerable uncertainty regarding which, if any, of these mechanisms is active, it makes sense to perform *as broad a set of tests as possible.*

Future ultrasonic examinations on other tanks should bracket at least one vertical weld with examination from both sides of the weld. Assuming that stress corrosion cracks, if such exist, can be either parallel to the weld or perpendicular to the weld, it will be necessary to align the transducers parallel or perpendicular to the weld to detect such flaws. This means that it will be necessary to scan the weld twice.

There should be an effort to examine at least one bottom plate, recognizing that conventional pulse echo UT will yield a very small sample of the plate, if one is limited to the area of the slots in the refractory concrete slab under the bottom plate. The best UT procedure would be one that permitted scanning of a larger region than that of a slot.

Knuckle Examination - The bottom knuckle region warrants the greatest immediate effort, both because the stresses are highest in the knuckle region and the geometry is the most difficult. As discussed at the meeting, there are two distinct issues: flaw detection and flaw sizing. Sub-TSIP concurs with the discussion held at the meeting that different approaches may be required for these two functions, and offer the following remarks that may be helpful in developing a solution.

Modes of Inspection - The problem is complicated by the fact that physical constraints cause the probe to be operated remotely from the region where stresses are highest and, hence, SCCs are most likely to occur (near the knuckle-bottom plate weld). Hence, the energy must propagate around the curve of the knuckle, reflect from the SCC, and return to the transducer resolved from other signals so that it can provide a basis for flaw detection and containing sufficient interpretable information to allow flaw sizing. The following three possible approaches may be considered:

(a) Using a high frequency probe, say 5 MHZ, such as is incorporated in the P-scan system used for the wall inspection, inject an angle beam into the upper portion of the knuckle. This will propagate the knuckle via multiple bounces. If a discontinuity is present, a signal will be reflected back to the transducer. The strength of this approach is that the sensitivity will likely be high due to the short wavelength of the 5 MHZ signals. The weakness is that the multiple bounces between the walls of the knuckles will lead to a multiplicity of returns, rendering quantitative interpretation of the data difficult. This problem is exacerbated by the curvature of the knuckle, leading to constantly changing angles of incidence and reflection and the possibility of generating mode converted signals.

(b) At the opposite extreme, one could attempt to use a single guided mode. Guided mode inspection is receiving a considerable amount of current attention in the research community, with a technical session being dedicated to this topic at the recent Review of Progress in Quantitative Nondestructive Evaluation. The proceedings will not be published until late spring or early summer, but copies of those papers can be made available to interested parties (contact R. B. Thompson). In this regime, the basic idea is to use a frequency such that the shear wavelength is greater than twice the knuckle thickness. This ensures that the propagation from transducer to SCC and back will be simple since it will only involve a single guide mode of the wall, thereby eliminating the complications associated with multiple reverberations that occur at 5 MHZ, as discussed in the previous section. For a 1-inch pipe, this frequency is approximately 50 kHz. Although such a measurement frequency appears rather low, it should be noted that a frequency of 130 kHz has been used to detect a variety of defects in buried natural gas pipelines, as discussed in one of the proceedings papers cited above. The strength of the guided mode technique is a relatively clean set of return signals, making interpretation simpler than in the high frequency measurements. The weakness is a lower sensitivity, since a defect would have to have penetrated through a significant fraction of the thickness of the knuckle wall to be detectable.

At an intermediate frequency, say 200-500 kHz, the shear wavelength will be less than the pipe wall thickness. Under such conditions, as noted by Posakony during the January 23 Review, it should be possible to excite a Rayleigh wave on the outer surface of the knuckle which will follow its curvature and interrogate the outer portion of the knuckle bottom plate weld. Such a mode might be particularly useful for sizing, as discussed below. A possible limitation of this approach, discussed in Viktorov's book entitled Rayleigh and Lamb Waves, is the fact that (at least for a flat plate) the energy will not stay indefinitely on the surface on which the Rayleigh wave is excited. Instead, it will flip from side to side, with a period given by 2/(ks-ka). In Viktorov's analysis, he notes that, rigorously speaking, one cannot speak of a Rayleigh wave on a plate, but should analyze phenomena in terms of Lamb (plate) waves. When the wavelength is small with respect to the plate thickness, what would intuitively be called a Rayleigh wave should more rigorously be thought of as a superposition of a symmetric (So) and antisymmetric (Ao) Lamb waves on the two surfaces of the plate which are weakly coupled due to the plate's finite thickness. The transducer then excites both the So and Ao mode, phased such that the signals on the same side of the plate as the transducer add constructively while the signals on the opposite side add destructively. This may appear to be an overly complex way to describe a simple measurement, but it predicts the phenomena, mentioned above, that the energy will be periodically transferred from one side of a flat plate to the other. In the formula cited, ks is the wave vector of the So mode at the measurement frequency while ka is that of the Ao mode. As frequency increases, ka and ks asymptotically approach one another and the distance for energy transfer becomes large and the effect is unimportant. However, this is not always the case. This effect has been experimentally confirmed for flat plates. However, the effect of plate curvature, such as exists in a knuckle, has not been quantified. It is recommended that scaled laboratory experiments be conducted to determine the extent to which such propagation phenomena come to bear in the knuckle problem.

Detection versus Sizing - Both the high frequency and guided mode (low frequency) approaches show promise for flaw detection. However, sizing may not be as simple. For the high frequency approach, the relationship between signal strength and flaw size may be quite complex. For the guided mode approach, it can be argued that the reflected signal should be proportioned to flaw area, at least for cracks transverse to the wall. Data supporting this view is included in one of the cited guided mode references. Determination of depth would require an independent relationship between length and depth, as might be obtained based on growth models. However, it should also be noted that the relationship to flaw size will be quite different for other types of defects such as pits. Significant sizing information may be provided by the intermediate frequency measurements. For example, as proposed by Posakony, measurement of the reflection coefficient for Rayleigh waves propagation on the outer surface could determine whether the crack had extended into the region interrogated by the wave. Repeating at several frequencies would bracket the maximum extent of the crack. Validating this hypothesis will require resolving some of the wave propagation questions for the intermediate frequency techniques as discussed above.

3. Acceptance Criteria

The criteria for reporting or acceptance of an indication, as presented by Keith Scott at the meeting, for the wall examinations, is consistent with the guidelines in the Tank Structural Integrity Report and appears appropriate.

4. <u>Lessons Learned from Single-Shell Tanks</u>

Records indicate large leakage of liquid from many single-shell tanks. It has been suspected that stress-corrosion cracking of the non-stress relieved tanks was the cause of the leakage. However, in spite of suspected leakage from about 70 tanks at Hanford, no engineering study was performed to determine the nature and cause of the damage. Therefore, it is recommended that a few single-shell tanks be examined to determine the degradation mechanisms and their relevance to the structural integrity of the remaining tanks that will be relied upon for a long period. Single-shell tank examination data may also be useful in other areas of TWRS (e.g., retrieval).

It is recognized that the scope of the current program does not include any such study and is pointed out that the demonstration of integrity of a tank through *limited inspection* (as is the current case) becomes weak when the cause of leakage from a vast number of tanks remains unexplored.

SUMMARY

It appears that very good progress is being made on developing a satisfactory double-shell tank examination. The above comments are offered as possible refinements and improvements of the solid foundation already established.

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PROJECT MANAGERS MEETING
March 5, 1997

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